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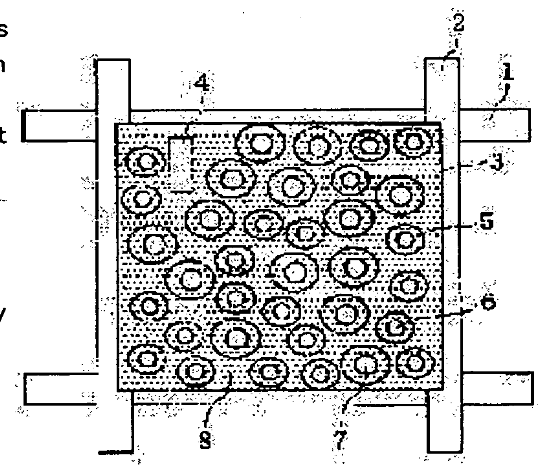
(54) SEMITRANSMITTING LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To improve reflectance and transmittance of semitransmission type liquid crystal panel.
SOLUTION: The semitransmission type liquid crystal display device has a semitransmitting layer having a rugged structure 5 having a reflection layer 3 and transmitting part 6. The transmitting part is formed in the region containing almost flat part of the rugged structure 5. The almost flat part of the rugged structure (namely, a part having a very small inclination angle) does not contribute to the reflectance of the panel but gives mirror reflection, which decreases the display performance. Thereby, by forming a transmitting part in the region including almost flat part in the rugged structure, mirror reflection can be prevented. By forming the transmitting part, the transmittance of light from the back light can be improved.



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CLAIMS

[Claim(s)]

[Claim 1] The transflective LCD characterized by forming said transparency section in the field containing the almost flat part of said concavo-convex structure in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed.

[Claim 2] The transflective LCD according to claim 1 with which the tilt angle which the first half irregularity structure of said flat part has is characterized by 0-degree or more being 2 degrees or less.

[Claim 3] The transflective LCD according to claim 1 with which the tilt angle which said concavo-convex structure of said flat part has is characterized by 0-degree or more being 4 degrees or less.

[Claim 4] The transflective LCD according to claim 1 characterized by said a part of transparency section [at least] not having a transparent electrode.

[Claim 5] The transflective LCD according to claim 1 characterized by said transparency section having a transparent electrode.

[Claim 6] The transflective LCD characterized by forming said transparency section in the field which contains some heights of said concavo-convex structure at least in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed.

[Claim 7] The transflective LCD according to claim 6 with which said transparency section is characterized by forming said top-most vertices in the symmetry as a core further including the top-most vertices of said heights.

[Claim 8] The transflective LCD according to claim 6 with which said transparency section is characterized by being further formed asymmetrically to said crowning including the top-most vertices of said heights.

[Claim 9] The transflective LCD according to claim 6 with which said transparency section is characterized by being prepared in the hemihedry of heights.

[Claim 10] The transflective LCD according to claim 6 characterized by having the unsymmetrical configuration to which the cross section of said heights changes from two or more inclined planes, and preparing said transparency section in the inclined plane where said unsymmetrical configuration is steep.

[Claim 11] The transflective LCD which the cross-section configuration of the heights of said concavo-convex structure is trapezoidal shape, and is characterized by being formed in the field to which said transparency section includes a part of top face of said trapezoid configuration at least in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed.

[Claim 12] The transflective LCD according to claim 11 with which the top-face configuration of said heights is characterized by being a polygon.

[Claim 13] The transflective LCD characterized by forming said transparency section in the field which contains the pars basilaris ossis occipitalis of the crevice of said concavo-convex structure at least in the transflective LCD with which the transflective layer which consists of the concavo-convex

structure of having the reflective section and the transparency section was formed.
[Claim 14] The transflective LCD according to claim 13 which the crevice of said concavo-convex structure has a pars basilaris ossis occipitalis, and is characterized by the pars basilaris ossis occipitalis of a crevice being still flatter.
[Claim 15] The transflective LCD according to claim 13 with which said reflective section is characterized by being asymmetrically formed to the crowning of said heights.
[Claim 16] The transflective LCD according to claim 15 with which said reflective section is characterized by being prepared in the hemihedry of said heights.
[Claim 17] The transflective LCD characterized by being formed in the field where said transparency section includes the top-most vertices of the heights of said concavo-convex structure at least, and the field containing the pars basilaris ossis occipitalis of a crevice in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed.
[Claim 18] The transflective LCD according to claim 17 with which the top-most vertices of said heights and a field with said crevice in which the transparency section was formed are characterized by the almost flat thing.
[Claim 19] The transflective LCD according to claim 8 or 11 characterized by for said transparency section having carried out mutually-independent, and forming it.
[Claim 20] The transflective LCD according to claim 19 with which said transparency section is characterized by having been arranged at random.
[Claim 21] The transflective LCD according to claim 13 or 17 characterized by forming said transparency section from the continuous configuration where the part was connected mutually.
[Claim 22] The transflective LCD according to claim 13 or 17 characterized by forming said reflective section from the continuous configuration where the part was connected mutually.
[Claim 23] The transflective LCD according to claim 13 or 17 characterized by realizing d1<d2 when thickness of the color filter layer on d1 and a crevice is set to d2 for the thickness of the color filter layer on the heights in said concavo-convex structure by forming a color filter layer on said concavo-convex structure.
[Claim 24] The transflective LCD according to claim 23 with which said d2 is characterized by being said twice as many abbreviation for d1 as this.
[Claim 25] The transflective LCD with which electrostatic capacity of the part to which said concavo-convex structure laps with said gate wiring is characterized by decreasing in the transflective LCD with which the transflective layer which consists of the concavo-convex structure where a part laps with gate wiring on a substrate was formed as the distance from the gate writing side of a liquid crystal panel increases.
[Claim 26] The transflective LCD according to claim 25 with which average thickness of the part to which said concavo-convex structure laps with said gate wiring is characterized by increasing as the distance from the gate writing side of a liquid crystal panel increases.
[Claim 27] The transflective LCD according to claim 26 characterized by the rate of surface ratio of heights increasing as the distance from the gate writing side of a liquid crystal panel increases [the rate of surface ratio of the heights of said concavo-convex structure, and a crevice which exists in the part which laps with said gate wiring].
[Claim 28] The transflective LCD with which electrostatic capacity of the part to which said concavo-convex structure laps with said source wiring is characterized by decreasing in the transflective LCD with which the transflective layer which consists of the concavo-convex structure where a part laps with the source wiring on a substrate was formed as the distance from the gate writing side of a liquid crystal panel increases.
[Claim 29] The transflective LCD according to claim 28 with which average thickness of the part to which said concavo-convex structure laps with said source wiring is characterized by increasing as the

distance from the gate writing side of a liquid crystal panel increases.
[Claim 30] The transflective LCD according to claim 29 characterized by the rate of surface ratio of heights increasing as the distance from the gate writing side of a liquid crystal panel increases [the rate of surface ratio of the heights of said concavo-convex structure, and a crevice which exists in the part which laps with said source wiring].
[Claim 31] The transflective LCD according to claim 25 or 28 characterized by said electrostatic capacity changing continuously.
[Claim 32] The transflective LCD characterized by having formed said transparency section in the field which includes the top-most vertices of the heights of said concavo-convex structure at least in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed, and having arranged the micro lens at the heights bottom of said concavo-convex structure.
[Claim 33] The transflective direction liquid crystal display characterized by having the pixel from which the rate of surface ratio of said transparency section differs in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed.
[Claim 34] The transflective LCD according to claim 33 characterized by having the range of the rate of surface ratio where it is not based on the rate of surface ratio of said transparency section, but a panel reflection factor becomes almost fixed.
[Claim 35] The transflective LCD with which said transparency section is characterized by being formed in the field to which the tilt angle which said concavo-convex structure has contains a part 10 degrees or more in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed.
[Claim 36] The transflective LCD with which said transparency section is characterized by being formed in the field to which the tilt angle which said concavo-convex structure has contains a part 10 degrees [or more] and a part 2 degrees or less in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the transflective LCD which can realize a low power by high brightness.
[0002]

[Description of the Prior Art] Although the reflective mold liquid crystal panel attracts attention with the rapid spread of mobile terminals etc., this reflective mold liquid crystal panel has the technical problem that visibility falls extremely, in indoor [dark] and dark Nighttime, while display engine performance sufficient in the environment where outdoor daylight, such as the outdoors, is strong is obtained, in order to display by reflecting outdoor daylight.
[0003] Then, the transflective type liquid crystal panel is proposed as an object which applies a reflective mold liquid crystal panel and can make the outdoors and indoor serve a double purpose. ** which such a transflective type liquid crystal panel prepares the transparency section in a part of toothing-like reflecting layer when a back light configuration is used, and prepares this transparency section in the center of a pixel by the shape of a square -- it was structure [like]. Moreover, it was usually that the above-mentioned concavo-convex structure takes the same structure for every pixel in consideration of the ease of creation conditions (refer to JP,10-319422,A).
[0004]
[Problem(s) to be Solved by the Invention] However, by the technique of preparing the transparency section in the center of a pixel of a reflecting layer greatly like the above, in order that all the parts of the transparency section might not contribute to reflection, when it used as a reflective mold, the technical problem from which sufficient brightness is not obtained occurred. Moreover, although the brightness in the case of a transparency mold is decided by area of the transparency section, when the transparency section is prepared regardless of concavo-convex structure like the above, the technical problem that the reflection factor of reflex time and the permeability at the time of transparency cannot be incompatible also occurs.
[0005] Furthermore, when a color filter layer was the same thickness in the time of transparency, and reflex time, the technical problem that absorption-of-light degrees differed in reflex time and the time of transparency, and hues differed by the time of transparency and reflex time occurred. Since, as for this, light goes and comes back to a color filter layer to reflex time, it is thought that it originates in the thickness of a substantial color filter layer becoming the twice at the time of transparency. When priority was given as a result, for example, a reflection factor, and the color filter with the high permeability for reflection was used, the technical problem that a color became thin also occurred at the time of transparency.
[0006] In addition, since concavo-convex structure was the almost same configuration for every pixel, its capacity configuration of a pixel is also the same in a screen. For this reason, when big screen-ization was attained, it ran in the gate sag resulting from wiring resistance of the gate or the source, and the values of an electrical potential difference differed in the field, and the technical problem that a flicker occurred also had them.
[0007]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention provided the following means in the transflective LCD of a back light configuration using the transflective reflection layer which concavo-convex structure has.
[0008] Invention according to claim 1 is characterized by forming said transparency section in the field containing the almost flat part of said concavo-convex structure in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed. Since the almost flat part (namely, part with a very small tilt angle) of concavo-convex structure serves as about [not contributing to a panel reflection factor] and specular reflection, it becomes the cause that the display engine performance falls on the contrary. Then, if the transparency section is formed in the field which contains the almost flat part of concavo-convex structure like the above-mentioned configuration, while being able to prevent specular reflection, when the transparency section exists, the light transmittance from a back light can be raised. In addition, the concrete operation effectiveness is explained in the operation effectiveness of following claim 2.
[0009] Invention according to claim 2 is characterized by the tilt angle which the first half irregularity

structure of said flat part has being 0 degrees or more 2 degrees or less in invention according to claim 1. It opts for the reflective engine performance of a transflective layer of having concavo-convex structure, with the tilt angle which the concavo-convex structure of the reflective section has. In order to condense efficiently the light which carries out incidence from a perimeter in the direction of an observer at this time, a tilt angle needs to arrange about 10 degrees by specific distribution from 2 degrees. At this time, the effectiveness that 2 degrees or less and small irregularity become close to specular reflection, and a tilt angle condenses light is small. Moreover, tone reversal occurs by specular reflection and visibility falls extremely. Therefore, the part which has 2 degrees or less and a small tilt angle becomes the cause that do not contribute to a panel reflection factor or the display engine performance falls on the contrary for specular reflection. For this reason, importance had set to form a reflecting layer so that a part with a small tilt angle may not be prepared conventionally. However, on the transflective type display which has a back light, this invention persons found out that improvement in a panel reflection factor could be aimed at while the tilt angle prevented specular reflection by making a small part into the transparency section.

[0010] Then, the concrete operation effectiveness of this invention is explained below in the comparison with a Prior art. The plan of the array substrate in the liquid crystal panel of the transflective LCD of the former [drawing 20] and drawing 21 are the sectional views of the array substrate in the liquid crystal panel of the conventional transflective LCD. When forming the concavo-convex structure 204 by the resist conventionally, and a flat part considered as the configuration which is not generated as much as possible, it had prevented that the tilt angle of a reflecting layer 202 became small. However, however it might form the concavo-convex structure 204, since the top-most vertices of heights became flat, they were the structure where a reflecting layer 202 was formed also in a flat part. Since it was considering as the transflective type by forming greatly the transparency section 205 which does not form a reflecting layer 202 in the center section of the pixel on the other hand, the concavo-convex structure 204 in the transparency section had not contributed to a reflection factor at all.

[0011] Drawing 22 (a) is the explanatory view showing an example of the beam-of-light locus in the reflecting layer of the conventional transflective type liquid crystal panel. Although the reflected light 210 in the ramp of concavo-convex structure contributes to the improvement in brightness, the specular reflection light 211 near heights top-most vertices serves as a cause of tone reversal. Moreover, only the transparent electrode 214 is formed in the ramp of the heights of the transparency section 213, and the transmitted light 215 occurs irrespective of concavo-convex structure. For this reason, the ramp of the heights of the transparency section 213 was structure which does not contribute to a panel reflection factor at all.

[0012] On the other hand, the transflective LCD of this invention is making the flat part in the concavo-convex structure of a reflecting layer into the transparency section, and it aims at improvement in brightness at the time of transparency while it prevents decline in a panel reflection factor. And coexistence of improvement with a reflection factor and permeability can be aimed at by making into the transparency section the part which does not contribute to a panel reflection factor in this way.

[0013] Drawing 22 (b) is the explanatory view showing an example of the beam-of-light locus in the reflecting layer of the transflective type liquid crystal panel of this invention. The transparency section 301 which has a transparent electrode 300 is formed near the top-most vertices of heights. By using this configuration, it generates all over a pixel and the panel reflection factor of the reflected light 302 in the inclined plane which contributes to the reflective engine performance improves. making into the transparency section 301 near the heights top-most vertices which tone reversal had generated with the configuration conventionally on the other hand -- tone reversal -- decreasing -- in addition -- and it becomes possible to also secure the permeability of a back light. Such operation effectiveness is demonstrated because panel permeability is decided by total area of the transparency section.

[0014] It is characterized by the tilt angle in which said concavo-convex structure of said flat part has invention according to claim 3 in invention according to claim 1 being 0 degrees or more 4 degrees or

'less. Thus, although the reflection factor in the location near the direction of specular reflection will fall if the tilt angle of 4 degrees or less is defined as a flat field, the panel reflection factor in the check-by-looking direction distant from specular reflection does not change, but the panel whose permeability improved further is obtained.

[0015] Invention according to claim 4 is characterized by said a part of transparency section [at least] not having a transparent electrode in invention according to claim 1. Since the electric-field response of the liquid crystal on the transparency section will be attained by the surrounding reflecting layer and the electric field during opposite even if there is no transparent electrode in the transparency section if the area of said transparency section is small, the same operation effectiveness as the above is demonstrated.

[0016] Invention according to claim 5 is characterized by said transparency section having a transparent electrode in invention according to claim 1. As long as the area of the transparency section is small like the above, there may be no transparent electrode in the transparency section, but if the area of the transparency section is large, it will be based on the reason it is desirable for a transparent electrode to exist in the transparency section.

[0017] Invention according to claim 6 is characterized by forming said transparency section in the field which contains some heights of said concavo-convex structure at least in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed. Since a flat part exists in heights, the transparency section, then the same operation effectiveness as claim 1 are demonstrated for the field containing the part.

[0018] Invention according to claim 7 is characterized by forming said transparency section in the symmetry considering said top-most vertices as a core further including the top-most vertices of said heights in invention according to claim 6. If the transparency section is formed in the field of concavo-convex structure which includes the top-most vertices of heights at least like the above-mentioned configuration, since top-most vertices will serve as a flat part in concavo-convex structure, while preventing decline in a panel reflection factor, improvement in brightness at the time of transparency can be aimed at. That is, coexistence of improvement with a reflection factor and permeability can be aimed at like the top-most vertices of heights by making into the transparency section the part which does not contribute to a panel reflection factor.

[0019] Invention according to claim 8 is characterized by forming said transparency section asymmetrically to said crowning including the top-most vertices of said heights further in invention according to claim 6.

[0020] Invention according to claim 9 is characterized by preparing said transparency section in the hemihedry of heights in invention according to claim 6. If the transparency section is prepared in the hemihedry of heights like the above-mentioned configuration (If the reflecting layer is prepared in the hemihedry of the heights of the opposite side while specifically preparing the transparency section in the hemihedry of the heights located in an observer side mainly) even if outdoor daylight will reflect with an observer's body and it will carry out incidence to a panel from an observer side In order to carry out outgoing radiation of the outdoor daylight to a rear-face side from the transparency section, reflected decreases, consequently its visibility improves.

[0021] In invention according to claim 6, invention according to claim 10 has the unsymmetrical configuration to which the cross section of said heights changes from two or more inclined planes, and is characterized by preparing said transparency section in the inclined plane where said unsymmetrical configuration is steep. When it was the above-mentioned configuration and a steep inclined plane is located in an observer side, the brightness at the time of transparency improves because back light light carries out incidence aslant from the transparency section of heights. Moreover, since the whole surface will serve as a reflecting layer mostly if it sees from a top face, it is effective in a reflection factor improving.

[0022] In the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed, the cross-section configuration of the heights of said concavo-convex structure is trapezoidal shape, and invention according to claim 11 is characterized by forming said transparency section in the field which includes a part of top face of said trapezoid configuration at least. Since the top face of a trapezoid configuration is flat, if the transparency section is formed in the field containing the part, the same operation effectiveness as the above will be acquired.
[0023] Invention according to claim 12 is characterized by the top-face configuration of said heights being a polygon in invention according to claim 11. When the flat-surface configuration of heights is made into a polygon, the azimuth of an inclined plane can set it as arbitration, and there is the operation effectiveness of adjusting viewing-angle bearing easily.
[0024] Invention according to claim 13 is characterized by forming said transparency section in the field which contains the pars basilaris ossis occipitalis of the crevice of said concavo-convex structure at least in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed.
[0025] In invention according to claim 13, the crevice of said concavo-convex structure has a pars basilaris ossis occipitalis, and invention according to claim 14 is characterized by the pars basilaris ossis occipitalis of a crevice being still flatter. If the transparency section is formed in the field which contains the flat part of a crevice at least, since it will say that the flat part of a crevice does not contribute to a panel reflection factor, improvement with a panel reflection factor and permeability can be aimed at like the above. Concretely, it explains using drawing 23 . Drawing 23 is the explanatory view showing an example of the beam-of-light locus in the reflecting layer of the transflective type liquid crystal panel of this invention. Improvement with a reflection factor and permeability can be aimed at by making the part 401 between heights 400 almost flat, and making the part 401 concerned into the transparency section.
[0026] Invention according to claim 15 is characterized by forming said reflective section asymmetrically to the crowning of said heights in invention according to claim 13. Invention according to claim 16 is characterized by preparing said reflective section in the hemihedry of said heights in invention according to claim 15.
[0027] If said reflective section is asymmetrically prepared in the crowning of said heights as shown in drawing 24 , outdoor daylight can be effectively condensed in the direction of an observer by the principle same with having mentioned above. If the reflective section is widely prepared in an observer and the opposite side like drawing 24 (a) at this time, the outdoor daylight which carries out incidence to an observer from the opposite side can be condensed effectively. On the other hand, like drawing 24 (b), if the reflective section is widely prepared in an observer side, the light which carries out incidence from behind [which was reflected with an observer's body] outdoor daylight or an observer can be condensed effectively. Moreover, if optimum dose mixture of the pattern of drawing 24 (a) and drawing 24 (b) is carried out, each condensing property can be made to be able to equalize with a mixed ratio of land use, and a condensing property can be adjusted more effectively.
[0028] Invention according to claim 17 is characterized by forming said transparency section in the field which includes the top-most vertices of the heights of said concavo-convex structure at least, and the field containing the pars basilaris ossis occipitalis of a crevice in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed. With such a configuration, a reflection factor and permeability can be raised further.
[0029] In invention according to claim 17, as for invention according to claim 18, the top-most vertices of said heights and a field with said crevice in which the transparency section was formed are characterized by the almost flat thing. Invention according to claim 19 is characterized by for said transparency section having carried out mutually-independent, and forming it in invention according to claim 8 or 11.

[0030] Invention according to claim 20 is characterized by having arranged said transparency section at random in invention according to claim 19. Thus, if arrangement of the transparency section is made random, diffraction does not occur but a panel without coloring or brightness nonuniformity can be obtained.

[0031] Invention according to claim 21 is characterized by forming said transparency section from the continuous configuration where the part was connected mutually in invention according to claim 13 or 19. Invention according to claim 22 is characterized by forming said reflective section from the continuous configuration where the part was connected mutually in invention according to claim 13 or 19. When the reflective section is formed with a conductive ingredient, electrical installation in a contact hole can be easily planned by making the reflective section into the continuous configuration where the part was connected mutually.

[0032] In invention according to claim 13 or 17, a color filter layer is formed on said concavo-convex structure, and invention according to claim 23 is characterized by realizing $d1<d2$, when thickness of the color filter layer on d1 and a crevice is set to d2 for the thickness of the color filter layer on the heights in said concavo-convex structure.

[0033] Although the light which carries out incidence as outdoor daylight and which is reflected by the reflecting layer penetrates the part of the color filter layer from which thickness is d1, by the time outdoor daylight results in a reflecting layer, while penetrating a color filter layer in this case, after being reflected by the reflecting layer, a color filter layer is penetrated again (that is, outdoor daylight will pass the color filter layer of thickness d1 twice). On the other hand, the transparence light which penetrates and carries out outgoing radiation of the crevice penetrates only once the color filter layer from which thickness is d2 from a back light. Therefore, since the transparence light from a back light will pass the color filter layer of the part to which thickness is large at the time of transparency even if it uses the color filter layer for high reflection of permeability if it is the above-mentioned configuration, even if it is the case of transparence light, sufficient color reproduction nature will be obtained.

[0034] Invention according to claim 24 is characterized by said d2 being said twice as many abbreviation for d1 as this in invention according to claim 23. If it is the above-mentioned configuration, since the transparency distance of the color filter layer in the transparence light and outdoor daylight from a back light will become equal, the almost same color reproduction nature is obtained by the time of transparency, and reflex time.

[0035] In the transflective LCD with which the transflective layer which consists of the concavo-convex structure where a part laps with gate wiring on a substrate was formed, invention according to claim 25 is characterized by decreasing as the distance from the gate writing side of a liquid crystal panel increases [the electrostatic capacity of the part to which said concavo-convex structure laps with said gate wiring]. In invention according to claim 25, invention according to claim 26 is characterized by increasing as the distance from the gate writing side of a liquid crystal panel increases [the average thickness of the part to which said concavo-convex structure laps with said gate wiring].

[0036] In invention according to claim 26, invention according to claim 27 is characterized by the rate of surface ratio of heights increasing as the distance from the gate writing side of a liquid crystal panel increases [the rate of surface ratio of the heights of said concavo-convex structure, and a crevice which exists in the part which laps with said gate wiring]. In the transflective LCD with which the transflective layer which consists of the concavo-convex structure where a part laps with the source wiring on a substrate was formed, invention according to claim 28 is characterized by decreasing as the distance from the gate writing side of a liquid crystal panel increases [the electrostatic capacity of the part to which said concavo-convex structure laps with said source wiring].

[0037] In invention according to claim 28, invention according to claim 29 is characterized by increasing as the distance from the gate writing side of a liquid crystal panel increases [the average thickness of the part to which said concavo-convex structure laps with said source wiring]. In invention according to claim 29, invention according to claim 30 is characterized by the rate of surface ratio of heights

increasing as the distance from the gate writing side of a liquid crystal panel increases [the rate of surface ratio of the heights of said concavo-convex structure, and a crevice which exists in the part which laps with said source wiring].
[0038] Invention according to claim 31 is characterized by said electrostatic capacity changing continuously in invention according to claim 25 or 28. Here, the operation effectiveness according to claim 25 to 31 is explained below.
[0039] At the time of a panel drive, by wiring resistance of the gate, gate voltage decreases as the distance from a writing side increases. For this reason, if the capacity of a pixel is the same in a field, a flicker occurs after writing. At this time, the opposite potentials Vcom required for a flicker dissolution differ in a field. Difference deltaVcom of the opposite potential in the ****** location when comparing with Vcom by the side of writing is expressed with the following formulas (1).
[0040]
deltaVcom=[(Cst+Cgd+Csd) /Clc] xdeltaVg -- (1)
capacity Csdbetween Cst:storage capacitance Cgd:gate drains: -- the source -- the difference [0041] of the gate voltage in each location within the field when comparing with the gate voltage initial value by the side of the capacity Clc:liquid crystal capacity deltaVg:writing between drains In order to reduce a flicker, even if the distance from a writing side follows on increasing and deltaVg increases continuously, it is necessary to maintain deltaVcom below at constant value. Therefore, according to the increment in deltaVg, it is necessary to decrease Cst(s), Cgd(s), and all the all [either or].
[0042] The parasitic capacitance by the concavo-convex structure formed in the lap field of gate wiring and a reflecting layer is contained in above Cst in equal circuit. Therefore, the effectiveness of reducing a flicker by decreasing the parasitic capacitance by the concavo-convex structure where the distance from a writing side followed on increasing, and was formed in the lap field of gate wiring and a reflecting layer is acquired. At this time, if the magnitude of the potential fall by resistance of gate wiring has the same wiring width of face, it will increase continuously according to the distance from a writing side. Therefore, a flicker can be reduced still more efficiently by changing the above-mentioned parasitic capacitance continuously.
[0043] Parasitic capacitance can specifically be changed by the average thickness of the concavo-convex structure formed in the lap field of gate wiring and a reflecting layer. It is defined as average thickness here with the value which broke the volume of the lap part of concavo-convex structure by the area of base of a lap part. Moreover, parasitic capacitance can be changed even if it changes the rate of surface ratio of heights and a crevice. If this has many heights of concavo-convex structure, average thickness will increase, and it is because it will decrease if there are many crevices.
[0044] When the flat film is generally used, and changing the value of parasitic capacitance continuously for every pixel, lap area is changed and thickness presupposes that it is fixed. Since thickness is decided by vacuum evaporationo, this is changed for every pixel, because it is difficult. however, when the film of concavo-convex structure is used, even when the thickness at the time of resist vacuum evaporationo is the same, the value of parasitic capacitance changes with the percentage of heights and a crevice easily. On the other hand, by the transflective type panel which has concavo-convex structure, if it laps and parasitic capacitance is changed in the area of the section, the part in which concavo-convex structure is not formed increases, brightness will fall, or the variation in brightness will occur in a field and display grace will fall. However, if the percentage of concavo-convex structure is changed and parasitic capacitance is changed, it will become possible to form concavo-convex structure in the whole surface, and a technical problem like a brightness fall will not be generated. Therefore, it is effective to change the percentage (namely, average thickness) of the heights of concavo-convex structure and a crevice, and to prevent a flicker by the transflective type panel which has the transflective layer which has concavo-convex structure.
[0045] Moreover, the parasitic capacitance of a lap part with source wiring is contained in Csd of a formula (1). Therefore, the effectiveness of reducing a flicker by decreasing the parasitic capacitance by

the concavo-convex structure where the distance from a writing side followed on increasing, and was formed in the lap field of source wiring and a reflecting layer by the same argument as the above is acquired. Moreover, also as for an effective thing, it is the same to change parasitic capacitance by the average thickness of concavo-convex structure.

[0046] In the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed, said transparency section is formed in the field which includes the top-most vertices of the heights of said concavo-convex structure at least, and invention according to claim 32 is characterized by having arranged the micro lens at the heights bottom of said concavo-convex structure. Since outgoing radiation is carried out from the transparency section which the light of a back light is condensed by the micro lens and located at the top-most vertices of heights with such a configuration, high brightness-ization at the time of transparency can be attained.

[0047] Invention according to claim 33 is characterized by having the pixel from which the rate of surface ratio of the transparency section differs in the transflective LCD with which the transflective layer which consists of the concavo-convex structure of having the reflective section and the transparency section was formed. In a liquid crystal display, brightness nonuniformity occurs according to the distance from a back light. At this time, there is an inclination for the brightness of a panel to become high, so that it is close to the part to which the back light has been arranged. Therefore, with the location within a field, if the rate of surface ratio of the transparency section of a pixel is changed, equalization of the brightness within a field can be attained. More specifically, the side near a back light should just make small the rate of surface ratio of the transparency section.

[0048] In invention according to claim 33, invention according to claim 34 is not based on the rate of surface ratio of said transparency section, but is characterized by having the range of the rate of surface ratio where a panel reflection factor becomes almost fixed. If the transparency section is prepared in the part where the tilt angle of concavo-convex structure is flat, in order that a flat part may not contribute to a panel reflection factor, it will not be based on the rate of surface ratio of the transparency section, but will become almost fixed [a panel reflection factor]. For this reason, equalization of the brightness within a panel side can be attained by both the time of transparency, and reflex time by the above-mentioned configuration.

[0049] In the transflective LCD with which the transflective layer which consists of the concavo-convex structure where invention according to claim 35 has the reflective section and the transparency section was formed, said transparency section is characterized by being formed in the field to which the tilt angle which said concavo-convex structure has contains a part 10 degrees or more. In the transflective LCD with which the transflective layer which consists of the concavo-convex structure where invention according to claim 36 has the reflective section and the transparency section was formed, said transparency section is characterized by being formed in the field to which the tilt angle which said concavo-convex structure has contains a part 10 degrees [or more] and a part 2 degrees or less.

[0050] There is a strong correlation in inclination distribution of concavo-convex structure, and the reflection property of a panel. For example, when condensing the reflected light in the range of 25 degrees from 0 degree of polar angles by 30-degree incidence, the tilt angle which contributes to condensing is in the range of about 2 to 10 degrees. At this time, the light reflected by the flat part 2 degrees or less turns into specular reflection light, and becomes a poor display. On the other hand, it is reflected in check-by-looking bearing and the opposite side, or the light reflected by the part with a steep tilt angle of 10 degrees or more is shut up inside a panel, turns into light, and does not contribute to condensing. Therefore, as mentioned above, also besides making a flat part into the transparency section, the reflection property in the check-by-looking range cannot change a tilt angle considering a part 10 degrees or more as the transparency section, and the area of the transparency section can increase, and improvement in brightness at the time of transparency can be aimed at.

[0051]

[Embodiment of the Invention] Below, the transflective LCD of this invention is explained with a drawing. (Gestalt 1 of operation) The plan of the array substrate of the transflective LCD concerning the gestalt 1 of operation of this invention in drawing 1 and drawing 2 are the sectional views of the array substrate of the transflective LCD concerning the gestalt 1 of operation of this invention. The transparency section 6 is formed in the field including the top-most vertices (crowning) 7 of the heights of the concavo-convex structure 5 in the reflecting layer (reflective section) 3 which has the concavo-convex structure 5.

[0052] Here, the top-most vertices 7 of the above-mentioned heights are flat, and since they reflect outdoor daylight in mirror plane, they do not contribute to improvement in a reflection factor. Moreover, if a reflecting layer is in a flat part, outdoor daylight will be reflected on the contrary, and tone reversal will occur. Therefore, a transflective LCD can be created, without reducing a reflection factor by making an almost flat field including the part of top-most vertices into the transparency section 6. Moreover, the originating tone reversal resulting from a flat part existing in top-most vertices can also be reduced. the inside of drawing and 1 -- gate wiring and 2 -- source wiring and 3 -- a reflecting layer and 4 -- a contact hole and 8 -- a pixel and 9 -- for the 2nd insulating layer and 12, as for the 1st contact layer and 14, an a-Si layer and 13 are [an array substrate and 10 / the 1st insulating layer and 11 / the 2nd contact layer and 15] transparent electrodes. [in addition,]

[0053] (Gestalt 2 of operation) The plan of the array substrate of the transflective LCD concerning the gestalt 2 of operation of this invention in drawing 3 and drawing 4 are the sectional views of the array substrate of the transflective LCD concerning the gestalt 2 of operation of this invention. The convex reflective section 21 and the transparency section 6 which constitutes an almost flat configuration while being prepared between the these convex reflective sections 21 are formed in the pixel electrode 20, and also it is the almost same configuration as the gestalt 1 of the above-mentioned implementation. While a reflection factor improves by the convex reflective section 21 with such a configuration, the effectiveness that permeability improves further is acquired by existence of the transparency section 6 of a large area.

[0054] Drawing 5 is the sectional view of the array substrate in which another gestalt of the gestalt 2 of operation is shown, and shows the case where the color filter layer 31 is formed on the array substrate 9. The thickness of the color filter layer 31 on a crevice 33 is regulated so that it may be set to d1<d2, when thickness of the color filter layer 31 on d2 and heights 30 is set to d1.

[0055] At this time, the light which carries out incidence as outdoor daylight and which is reflected by the reflecting layer 3 penetrates the part (heights 30 of the color filter layer 31) of the color filter layer 31 from which thickness is d1. By the time outdoor daylight results in a reflecting layer 3, while penetrating the color filter layer 31 at this time, after being reflected by the reflecting layer 3, the color filter layer 31 is penetrated again (that is, outdoor daylight will pass the color filter layer 31 of thickness d1 twice). On the other hand, the transparence light which penetrates and carries out outgoing radiation of the transparent electrode 15 of a crevice 33 penetrates only once the part (crevice 33 of the color filter layer 31) of the color filter layer 31 from which thickness is d2 from a back light 23. Therefore, since the transparence light from a back light 23 will pass the color filter layer 31 of the part to which thickness is large at the time of transparency even if it uses the color filter layer 31 for high reflection of permeability if it is d1<d2 like the above-mentioned configuration, even if it is the case of transparence light, sufficient color reproduction nature will be obtained.

[0056] Moreover, if the thickness d2 of the color filter layer 31 on a crevice 33 is set up so that it may become twice the thickness d1 of the color filter layer 31 on heights 30 in case the thickness of the color filter layer which light penetrates is set up, since the transparency distance of the color filter layer 31 in the transparence light and outdoor daylight from a back light 23 will become equal, the almost same color reproduction nature will be obtained by the time of transparency, and reflex time. in addition, drawing -- setting -- 24 -- for a polarizing plate and 27, as for an opposite substrate and 29, an insulating layer and 28 are [a lamp cover and 25 / a transparent material and 26 / a TFT component

and 32] liquid crystal layers.
[0057] (Gestalt 3 of operation) Drawing 6 is the plan of the array substrate of the transflective LCD concerning the gestalt 3 of operation of this invention. The convex reflective section 21 which has the 1st transparency section 40 in the pixel electrode 20 is formed. The 1st transparency section 40 is formed in the field including the top-most vertices 7 of heights at this time. On the other hand, the 2nd transparency section 41 is formed in the crevice 33 of the pixel electrode 20. Since the 1st transparency section 40 and the 2nd transparency section 41 exist while a reflection factor improves by the convex reflective section 21 if it is such a configuration, the area of the whole transparency section becomes large and the effectiveness of the improvement in permeability is acquired. Moreover, the effectiveness of reducing the specular reflection which originates in a flat part existing in heights top-most vertices by forming the 1st transparency section 40 in a field including the top-most vertices 7 of the convex reflective section 21 is also acquired.
[0058] (Gestalt 4 of operation) The block diagram of the transflective LCD concerning the gestalt 4 of operation of this invention in drawing 7 , drawing 8 (a), and (b) are the plans of the array substrate of the transflective LCD concerning the gestalt 4 of operation of this invention. When a pixel A54 and a pixel B55 existed along the write-in direction 56 of gate potential, the plan of drawing 8 (a) and a pixel B55 was shown for the plan of a pixel A54 in drawing 8 (b). In the lap part 59 of the gate wiring 1 and a pixel 58, depending on the direction of the write-in direction 56, the percentage of each heights of a pixel A54 and a pixel B55 and a crevice has composition with the high percentage of heights, so that it is far from writing side of the gate 57. Thus, if the percentage of heights is high, average thickness will increase and parasitic capacitance will decrease as a result. Since it is such, a flicker can be reduced by this configuration. In addition, for 50, as for a display pixel field and 52, in drawing 8 , a liquid crystal panel and 51 are [Source IC and 53] Gates IC.
[0059] (Gestalt 5 of operation) In the same configuration as the gestalt 4 of operation, the average thickness of the lap parts of source wiring 901 and a pixel 906 constitutes so that it may differ according to the distance from a writing side.
[0060] (Gestalt 6 of operation) Drawing 9 is the sectional view of the transflective LCD concerning the gestalt 6 of operation of this invention. While the transparency section 6 which penetrates the light from a back light (not shown) is formed in a field including the top-most vertices 7 of the heights of the concavo-convex structure 5, the micro lens 70 is formed in the rear-face side. The back light light 71 is condensed by the transparency section 6 by the above-mentioned micro lens 70, and outgoing radiation is carried out. For this reason, if it is original, the light which it is reflected with the rear face of a reflecting layer 3, and does not carry out outgoing radiation to an observer side also becomes possible [penetrating the transparency section 6], and can attain high brightness-ization.
[0061] (Gestalt 7 of operation) Drawing 10 is the block diagram of the transflective LCD display concerning the gestalt 7 of operation of this invention. The back light 23 was arranged in the transparent material 25, and the laminating of a diffusion layer 80 and the transflective type liquid crystal panel 81 grade was carried out on the transparent material 25. And according to the distance from a back light 23, equalization of the brightness within a field can be attained by changing the rate of surface ratio of the transparency section 6 of the pixel of the transflective type liquid crystal panel 81.
[0062] (Gestalt 8 of operation) Drawing 11 is the block diagram of the transflective LCD concerning the gestalt 8 of operation of this invention. After forming the concavo-convex structure 5 on the array substrate 9, the tilt angle of the concavo-convex structure 5 forms a reflecting layer 3 in a field 10 degrees or less. Therefore, as for the transparency section 6, a tilt angle is equivalent to a part 10 degrees or more. By this configuration, since a field 10 degrees or more serves as [the tilt angle which does not contribute to condensing to the check-by-looking direction] the transparency section, a reflection factor cannot change but improvement in brightness at the time of transparency can be aimed at.
[0063]

[Example] Next, the example of this invention is explained.
(Example 1) It is an example corresponding to the gestalt 1 of said operation, and explains using drawing 1 and drawing 2 which were shown with the gestalt 1 of operation. First, after having used silicon oxide, crossing gate wiring to the whole surface in the wrap form and forming the 1st insulating layer 10 on the array substrate 9 with which the gate wiring 1 and source wiring 2 were formed, the a-Si layer 12, the 1st contact layer 13, and the 2nd contact layer 14 were formed on this 1st insulating layer 10, and it considered as the TFT component. Next, after forming the 2nd insulating layer 11 all over a substrate with silicon oxide etc., the photoresist was applied to the whole surface and the concavo-convex structure 5 was formed using mask exposure. Subsequently, after forming a contact hole 4, the transparent electrode 15 was formed, aluminum was vapor-deposited further and the reflecting layer 3 was formed. At this time, aluminum is not vapor-deposited in a field including the top-most vertices 7 of the heights of the concavo-convex structure 5, but the transparency section 6 is formed in the top-most vertices 7 of heights of this. In addition, since it had the reflecting layer 3 while it was making a field including the top-most vertices 7 of heights into the transparency section 6, and back light light penetrated the transparency section 6 and being able to use it as a transparency mold, since the top-most vertices of the heights of concavo-convex structure were almost flat, it became usable also as a reflective mold.
[0064] The rate of surface ratio occupied to the pixel 8 of the transparency section 6 at this time was 30%. And the reflection factor was 30%, when incidence of the diffused light was carried out and the panel reflection factor was measured. The result of having changed the rate of surface ratio of the transparency section from 0% to 100%, and having measured the panel reflection factor was shown in drawing 12 . The measurement result of the transflective LCD which has the transparency section of a configuration conventionally which was shown in drawing 20 and drawing 21 for the comparison was appended to drawing 12 . In the conventional example, an increment of the rate of surface ratio of the transparency section decreased the panel reflection factor in monotone so that clearly from drawing 12 . This is because corresponding to 1:1 in the rate of surface ratio and panel reflection factor of the transparency section in the conventional example.
[0065] On the other hand, in this example, when the rate of surface ratio of the transparency section was small, it was not based on the rate of surface ratio of the transparency section, but the panel reflection factor was almost fixed. At this time, 25% had the almost fixed rate of surface ratio. Although the panel reflection factor decreased according to the increment in the rate of surface ratio, when the same rate of surface ratio compared, the high reflection factor was obtained as compared with the conventional example. Moreover, since permeability corresponded to the rate of surface ratio of the transparency section, and 1:1, when it was the configuration of this example as a result, compared with the configuration of the conventional example, the panel with both high panel reflection factors and permeability was obtained.
[0066] Furthermore, in this example, it was not based on the rate of surface ratio of the transparency section, but the range of the rate of surface ratio where a panel reflection factor becomes almost fixed existed so that clearly from drawing 12 . In order that the field where this has the as small tilt angle of heights as 2 degrees or less may not contribute to a panel reflection factor, it is for a panel reflection factor not changing considering the field where a tilt angle is small as the transparency section. Moreover, that a panel reflection factor will fall if the rate of surface ratio of the transparency section becomes large originates in the part which has the tilt angle which contributes to a panel reflection factor serving as the transparency section, if the rate of surface ratio of the transparency section increases.
[0067] In addition, although the transparency section may form the top-most vertices of heights in the symmetry as a core, it may not be limited to this and may be asymmetrically formed to the top-most vertices of heights. If the transparency section becomes large, the transparency section will exist in the part of the inclination which contributes to the reflective engine performance, and a reflection factor will

fall. As shown in drawing 13 , when forming the transparency section 6 in heights at this time, permeability can be secured without reducing a reflection factor by forming many reflecting layers 3 in a side with many amounts of incidence of outdoor daylight in consideration of the check-by-looking direction of a panel, and forming many transparency sections 6 in a panel lower part side (the inside of drawing, down) including top-most vertices 7. That is, when forming the transparency section 6 which includes the top-most vertices 7 of heights 30 in outdoor daylight side 101 of drawing 13 , and observer side 10, it is desirable to form the transparency section 6 for increasing in observer side 102.

[0068] Moreover, it is necessary to form the transparency section 6 near [no / top-most-vertices 7] heights 30, and it may be formed in some heights 30 in consideration of extent of tone reversal. Thus, if the transparency section 6 is formed in some heights 30, a reflection factor can be adjusted easily. Furthermore, the configuration of the transparency section may not be limited to the configuration shown in above-mentioned drawing 13 R> 3, and as shown in drawing 14 R> 4, it may be prepared in the hemihedry located in the observer 103 side of heights. In this case, even if outdoor daylight 104 reflects with an observer's 103 body and it carries out incidence to a panel from an observer side, in order to carry out outgoing radiation of the outdoor daylight 104 to a rear-face side from the transparency section 6, reflected decreases and the effectiveness that visibility improves is demonstrated.

[0069] In addition, as shown in drawing 15 , the cross-section configuration of heights 30 may be set as the non-object, and the transparency section 6 may be further formed in the steep inclined plane located in an observer 103 side. At this time, the brightness at the time of transparency improves by condensing using an optical element 105 and carrying out incidence of the back light light 71 aslant from the transparency section 6 of heights 30. Moreover, since the whole surface will serve as a reflecting layer 3 mostly if it sees from a top face, it is effective in a reflection factor improving. Moreover, it is not necessary to necessarily form a transparent electrode in the reflecting layer bottom, and it may be formed in the reflecting layer bottom. Moreover, even if a transparent electrode is not the whole surface, it should just be in a part. For example, if it is the configuration which requires some transparent electrodes for a surrounding reflecting layer including the transparency section, a flow can fully be aimed at. Furthermore, if the area of the transparency section is small, even if there is no transparent electrode in the transparency section, the electric-field response of the liquid crystal on the transparency section will be attained by the surrounding reflecting layer and the electric field during opposite, and the same effectiveness as the above will be acquired. For example, when a panel gap is 10 micrometers, as long as the transparency section is 8 micrometers or less, there may be no transparent electrode. Moreover, a panel gap is the same even if the transparency section is 3 micrometers or less in about 5 micrometers.

[0070] In addition, heights 30 do not necessarily need to have top-most vertices, and may be trapezoid configurations like drawing 16 . In this case, the same effectiveness is acquired by making the top face of a trapezoid configuration into the transparency section 6. Moreover, from a top, the configuration of the seen heights 30 may not be circular and a polygon is sufficient as it. Thus, if the flat-surface configuration of heights 30 is made into a polygon, the azimuth of an inclined plane can set it as arbitration, and the effectiveness of adjusting viewing-angle bearing will be born.

[0071] Furthermore, as for the ratio of the transparency section and a reflecting layer, changing according to the main operation is desirable. For example, if use on the outdoors is main, 60% or more of the ratio of a reflecting layer is good. Since the reflection factor of the usual reflective mold panel is about 35%, if the ratio of the reflective section is 60% or more, the reflection factor of a panel will become 20% or more, and the level which can enough be checked by looking will be obtained. A good display is obtained because the model used as a transparency mold like the pocket mold note PC on the other hand in many cases makes the ratio of the transparency section high.

[0072] In addition, although the field with a tilt angle of 2 degrees or less was used as a flat part in the above-mentioned example 1, it does not limit to this. Generally, in a field with the tilt angle near 0 degree, the panel reflection factor in the check-by-looking direction near specular reflection is

determined, and the field where a tilt angle is large determines the panel reflection factor in the include angle which is separated from specular reflection. Although the reflection factor in the location near the direction of specular reflection will fall if it follows, for example, the tilt angle of 4 degrees or less is defined as a flat field, the panel reflection factor in the check-by-looking direction distant from specular reflection does not change, but the panel whose permeability improved is obtained.

[0073] (Example 2) It is an example corresponding to the gestalt 2 of said operation, and explains using drawing 3 and drawing 4 which were shown with the gestalt 2 of operation. Although it is the almost same configuration as the gestalt 1 of operation, while forming a reflecting layer only in the heights of the concavo-convex structure 5 and considering as the convex reflective section 21, it differs at the point made into the structure of making a back light penetrating by making a crevice into almost flat structure, and making this flat crevice into the transparency section by considering a resist as a configuration further.

[0074] Here, since the resist was made into 1 lamination like the above, if simplification of a manufacture process can be attained and the convex reflective section 21 is further formed with conductors, such as aluminum, it can be used as an electrode by connecting with the transparent electrode 15 of a crevice electrically. Under the present circumstances, if the gap of the liquid crystal layer of a crevice is made into twice the gap of the liquid crystal layer in heights, the retardation of a liquid crystal layer will become the same by the time of transparency, and reflex time. Since the rate of light modulation of a liquid crystal layer becomes the same also at the time of reflex time and transparency at this time, brightness improves. Moreover, what is necessary is just to set 6 micrometers and liquid crystal thickness of heights to about 3 micrometers for the liquid crystal thickness of a crevice at the time of the design of a liquid crystal layer. Moreover, it is desirable to be able to twist the liquid crystal of a liquid crystal layer and to make an angle into the range of 40 to 90 degrees according to the reason for both obtaining high brightness at reflex time and the time of transparency.

[0075] Furthermore, what is necessary is to be able to change the rate of surface ratio of heights and a crevice according to the application of a panel, for example, just to change the rate of surface ratio of the crevice to a pixel 8 in 20 to 70% of range.

[0076] Drawing 17 is a plan concerning another gestalt of an array substrate, it is the convex reflective section's 21 being mutually connected through a connection 110, and connecting with a contact hole 4 further, and the convex reflective section 21 acts as a reflector. Thus, when the convex reflective section 21 is produced in the mutually connected configuration, there is an advantage that electrical installation between the electrode of the reflective section and a contact hole can be planned easily. Moreover, a connection 110 does not need to be the not necessarily same height as the convex reflective section 21, and as long as it can connect the convex reflective section 21 electrically mutually, it may be thin. Moreover, if a connection 110 is made from the same height as the convex reflective section 21, the effectiveness that a reflection property improves will be acquired according to tilt-angle distribution of connection 1906 the very thing.

[0077] (Example 3) It is an example corresponding to another gestalt of the gestalt 2 of said operation, and explains using drawing 5 shown with the gestalt 2 of operation. First, on the insulating layer 27, the transparent electrode 15 was vapor-deposited, and further, heights 30 were formed so that it might become height of 3 micrometers, and width of face of 9 micrometers. It was made into the flat crevice 33 between heights 30, and width of face of this crevice 33 was set to 3 to 5 micrometers. Moreover, since the reflecting layer 3 is formed in the above-mentioned heights 30, a crevice 33 turns into the transparency section. At this time, the rate of surface ratio of the transparency section to a pixel 8 was made into 48%.

[0078] Next, the color filter ingredient was applied and the color filter layer 31 of RGB was formed for every pixel by patterning processing. At this time, since the pitch of a crevice 33 and heights 30 was as small as several micrometers - about 10 micrometers, the color filter ingredient had the thick crevice 33, and heights 30 were applied to the thin configuration. Specifically, the thickness of the color filter layer

31 was 1 micrometer in the crevice 33 at 1.9 micrometers and heights. Thus, the thickness at the time of spreading of a color filter ingredient can differ, and the thickness of the color filter layer 31 can be made to differ as a result by using the concavo-convex structure 5 where a pitch is small.

[0079] Then, the panel was formed so that the thickness of the liquid crystal layer of heights 30 might be set to 3 micrometers, and it considered as the transflective LCD. Here, reflex time and the time of transparency estimated the display engine performance of a panel. Consequently, since the transparency section was prepared in the flat part, the value with a as high reflection factor as 35% was acquired. Moreover, the rate of surface ratio of the transparency section was also as high as 40%. In addition, since the thickness of a color filter layer was making it differ by the crevice and heights, what also has the almost same color reproduction nature was obtained in reflex time and the time of transparency.

[0080] In addition, what is necessary is not to limit the configuration of heights and a crevice, and the thickness of a color filter layer to the above-mentioned value, and just to form [0.5 micrometers to 2 micrometers, and the reflective section] the thickness of a color filter layer by 0.25 to about 1 micrometer in the transparency section that heights should just be 1 to about 5 micrometers in height.

[0081] (Example 4) It is an example corresponding to the gestalt 3 of said operation, and explains using drawing 6 shown with the gestalt 3 of operation. The field which includes the top-most vertices 7 of the 2nd transparency section 41 and the convex reflective section 21 for the crevice of the pixel electrode 20 was made into the 1st transparency section 40. Since a flat part serves as the transparency section over the whole region mostly with such a configuration, the improvement in brightness at the time of a transparency mold and the effectiveness of specular reflection prevention of reflex time are acquired.

[0082] (Example 5) It is an example corresponding to the gestalt 4 of said operation, and explains using drawing 7 shown with the gestalt 4 of operation and drawing 8 (a), and (b). When width of face of the gate wiring 1 was set to 4 micrometers, the pixel 58 was considered as the configuration which laps with the gate wiring 1 by the width of face of 1.5 micrometer. At this time, an adjacent pixel inter-electrode distance was 1 micrometer. And when spreading resist thickness at the time of creating the concavo-convex structure 5 was set to 3 micrometers, the maximum level difference of the concavo-convex structure 5 after development was 2 micrometers. Moreover, the thickness of the insulating layer formed in the bottom of a resist could be 1.5 micrometers. Therefore, in the field with which the gate wiring 1 and a pixel 58 lapped, the thickness to the base of 4.5 micrometers and a crevice of the thickness from the gate wiring 1 to the top-most vertices of the heights of the concavo-convex structure 5 was 2.5 micrometers.

[0083] On the other hand, according to the distance from writing side of gate potential 57, the rate of surface ratio of the heights 30 of the concavo-convex structure 5 and a crevice 33 which exists in the lap part 59 of the gate wiring 1 and a pixel 58 was changed continuously. At this time, the rate of surface ratio of heights 30 was made high as it separated from writing side 57 along the write-in direction 56. Specifically, the ratio of heights 30 was changed from 20% to 90% in the screen. If the rate of surface ratio of heights 30 and a crevice 33 is correlated with average thickness and heights 30 are increased, the same operation will be demonstrated as average thickness increases.

[0084] Since the value of parasitic capacitance was optimized in a field by this configuration according to a fall degree even if gate potential falls by wiring resistance, the flicker decreased sharply to 100mV or less, and the good display was obtained. In addition, although gate potential is single-sided electric supply in the above-mentioned example, it does not limit to this and, of course, both-sides electric supply is sufficient. Thus, if it writes in and parasitic capacitance is changed according to bearing also when it considers as both-sides electric supply, the same operation as the above and effectiveness will be demonstrated. When it considers as both-sides electric supply, specifically, the design of parasitic capacitance serves as bilateral symmetry for every line. Since the concavo-convex structure of a lap part contributes to the reflective engine performance, when it is made both-sides electric supply, it is effective in that the reflective engine performance in every line is equalized, and equalization of a display

can plan.

[0085] Moreover, although the above-mentioned example changed the surface ratio of the concavo-convex structure of the lap part of a pixel and gate wiring, it may not be limited to this and may change the surface ratio of the concavo-convex structure of the lap parts of source wiring and a pixel. Moreover, even if it changes the surface ratio of the lap part of the both sides of gate wiring and source wiring, there is same effectiveness. And the value of parasitic capacitance can be further adjusted to arbitration by changing the both sides of gate wiring and source wiring.

[0086] (Example 6) It is an example corresponding to the gestalt 6 of said operation, and explains using drawing 9 shown with the gestalt 6 of operation. First, after forming the gate wiring 1 and 1st insulating-layer 10 grade on the array substrate 9, the micro lens 70 was created using ultraviolet curing mold resin. Next, after carrying out flattening of the whole using the 2nd insulating layer 11, the concavo-convex structure 5 grade was formed. At this time, the top-most vertices 7 of a crevice 33 were made into the transparency section. By repeating lens arrangement of a micro lens 70, and arrangement of heights 30, it was condensed by the micro lens 70 and the back light light 71 considered as the configuration which carries out outgoing radiation from the transparency section 6. At this time, lens width of face of a micro lens 70 was set to 10 micrometers, and thickness was set to 1.5 micrometer. Moreover, width of face of heights was set to 12 micrometers.

[0087] Like the above, since it was condensed by the micro lens 70 and the back light light 71 carried out outgoing radiation from the transparency section 6 by forming a micro lens 70 in the heights 30 bottom (that is, the rate that the back light light 71 is reflected by the reflecting layer 3 can be reduced), brightness improved by that. And when were experimented about the brightness property and a micro lens 70 was formed, it was admitted compared with the case where a micro lens 70 is not formed that brightness increased 120%.

[0088] In addition, the 2nd insulating layer 11 may not be limited to the structure of forming on a micro lens 70, and may be formed in the micro-lens 70 bottom. It becomes possible using such structure, then the lens configuration of a micro lens 70 to form heights 30. If the 2nd insulating layer 11 is used, the transparency section 6 of heights 30 can be formed according to the focal distance of a micro lens 70, and the condensing effectiveness of back light light will improve. It is desirable to use a 1 to about 5 micrometers thing as a focal distance of a micro lens 70 from a viewpoint which controls the increment in the thickness of the 2nd insulating layer 11.

[0089] (Example 7) It is an example corresponding to the gestalt 7 of said operation, and explains using drawing 10 shown with the gestalt 7 of operation. According to the distance from a back light 23, the rate of surface ratio of the transparency section of a pixel was changed. The relation between the relative position in a panel, the rate of surface ratio of the transparency section, and a ** panel reflection factor was shown in drawing 18 . As for the relative position in a panel, the back light side specified 0 and the opposite side as 1. When changing the rate of surface ratio to 50% (relative position 1) from 35% (relative position 0) as are shown in drawing 18 , and it kept away from the back light, the panel reflection factor decreased from 35% to 30%. However, it is thought that extent of reduction is very small and is a reflection factor almost uniform in a field. Moreover, although not shown in drawing 18 , it was admitted that the transparency reinforcement of back light light was also almost uniform in a field.

[0090] Thus, the uniform brightness within a field is [both] realizable by the time of transparency, and reflex time adjusting the rate of surface ratio of the transparency section of a pixel to a panel according to the intensity distribution of the back light at the time of carrying out incidence. In addition, if the transparency section is prepared in the flat part of concavo-convex structure as shown in said drawing 12 , the field where a panel reflection factor does not change even if it changes the rate of surface ratio of the transparency section will be obtained. For this reason, if the rate of surface ratio in within the limits of the above-mentioned field is mainly used even if it changes the rate of surface ratio of the transparency section by the pixel in a panel, even if it changes the rate of surface ratio of the

transparency section within a panel, a panel reflection factor can be mostly made regularity.

[0091] (Example 8) It is an example corresponding to the gestalt 8 of said operation, and explains using drawing 11 shown with the gestalt 8 of operation. The concavo-convex structure 5 was formed in width of face of 10 micrometers, and height of 3 micrometers on the array substrate 9. Drawing 19 is a graph which shows tilt-angle distribution of the concavo-convex structure 5. The tilt angle was missing from 10 degrees from 0 degree, and distribution increased almost in monotone and decreased in monotone with a peak of 10 degrees. The greatest tilt angle was 20 degrees.

[0092] In consideration of the above-mentioned thing, the tilt angle of the concavo-convex structure 5 formed the reflecting layer 3 in the field 10 degrees or more using the aluminum containing alloy. At this time, the rate of surface ratio of the transparency section 91 and the reflective section 90 was pixel surface ratio, the transparency section 91 was 40% and the reflective section 90 was 60%. When the reflection factor was investigated with such a configuration, in order that the transparency section 91 in the concavo-convex structure 5 might not contribute to condensing of reflex time, the value with a as high reflection factor as 30% was acquired. On the other hand, since there was 40% of the transparency sections 91 by pixel surface ratio, high brightness was obtained also in the time of transparency.

[0093] In addition, although the tilt angle made only the field 10 degrees or more the transparency section in the above-mentioned example, it does not limit to this and is good also as the transparency section also including a flat part [as / whose tilt angle is 2 degrees or less]. Since the area of the transparency section increases preventing decline in a reflection factor with such a configuration since a flat part does not contribute to condensing, further high brightness-ization can be attained at the time of transparency.

[0094] Moreover, a tilt angle may not limit the field of the transparency section only to a field 10 degrees or more, and a tilt angle may form it in fields, such as 12 degrees or more and 15 etc. degrees or more. And if a tilt angle makes a field 12 degrees or more the transparency section, when the check-by-looking range will make a field 15 degrees or more as breadth and a tilt angle will make it the transparency section to −5 degrees by the polar angle, it is effective in the check-by-looking range spreading to −10 degrees in a polar angle.

[0095]

[Effect of the Invention] As mentioned above, according to this invention, permeability can be improved, without falling a reflection factor to a reflecting layer by making the comparatively flat part of a reflecting layer transparent with the transflective type liquid crystal panel of the back light method which has the transparency section. Moreover, the effectiveness of flicker reduction is acquired by gate potential writing in the concavo-convex structure of the lap parts of the gate, source wiring, and a pixel, and changing according to bearing.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing 1 is the plan of the array substrate of the transflective LCD concerning the gestalt 1 of operation.
[Drawing 2] Drawing 2 is the sectional view of the array substrate of the transflective LCD concerning the gestalt 1 of operation.
[Drawing 3] Drawing 3 is the plan of the array substrate of the transflective LCD concerning the gestalt 2 of operation.
[Drawing 4] Drawing 4 is the sectional view of the array substrate of the transflective LCD concerning the gestalt 2 of operation.
[Drawing 5] Drawing 5 is the sectional view of the array substrate in which another gestalt of the gestalt 2 of operation is shown.
[Drawing 6] Drawing 6 is the plan of the array substrate of the transflective LCD concerning the gestalt 3 of operation.
[Drawing 7] Drawing 7 is the block diagram of the transflective LCD concerning the gestalt 4 of operation of this invention.
[Drawing 8] Drawing 8 (a) and (b) are the plan of the array substrate of the transflective LCD concerning the gestalt 4 of operation of this invention.
[Drawing 9] Drawing 9 is the sectional view of the transflective LCD concerning the gestalt 6 of operation of this invention.
[Drawing 10] Drawing 10 is the block diagram of the transflective LCD display concerning the gestalt 7 of operation of this invention.
[Drawing 11] Drawing 11 is the block diagram of the transflective LCD concerning the gestalt 8 of operation of this invention.
[Drawing 12] The graph which shows the relation between the rate of surface ratio of the transparency section, and a panel reflection factor
[Drawing 13] Drawing 13 is the plan showing the modification of the array substrate of the transflective LCD concerning an example 1.
[Drawing 14] Drawing 14 is the plan showing other modifications of the array substrate of the transflective LCD concerning an example 1.
[Drawing 15] Drawing 15 is the plan showing the modification of further others of the array substrate of the transflective LCD concerning an example 1.
[Drawing 16] Drawing 16 is the plan showing other modifications of the array substrate of the transflective LCD concerning an example 1.
[Drawing 17] Drawing 17 is the plan showing the modification of the array substrate of the transflective LCD concerning an example 2.
[Drawing 18] Drawing 18 is a graph which shows the relation between the relative position in a panel, the rate of surface ratio of the transparency section, and a ** panel reflection factor.
[Drawing 19] Drawing 19 is a graph which shows tilt-angle distribution of the concavo-convex structure 5.
[Drawing 20] Drawing 20 is the plan of the array substrate of the conventional transflective LCD.
[Drawing 21] Drawing 21 is the sectional view of the array substrate of the conventional transflective LCD.
[Drawing 22] For drawing 22 (a), drawing 22 (b) is the explanatory view showing the beam-of-light locus in the reflecting layer in the conventional transflective LCD, and the explanatory view showing the beam-of-light locus in the reflecting layer in the transflective LCD of this invention.
[Drawing 23] Drawing 23 is the explanatory view showing the beam-of-light locus in the reflecting layer

in the transflective LCD concerning other examples of this invention.

[Drawing 24] Drawing 24 (a) is the plan of an array substrate which prepared the reflective section in an observer and the opposite side widely, and drawing 24 (b) is the plan of an array substrate which prepared the reflective section in the observer side widely.

[Description of Notations]

1 Gate Wiring
2 Source Wiring
3 Reflecting Layer
4 Contact Hole
5 Concavo-convex Structure
6 Transparency Section
7 Top-most Vertices
8 Pixel
9 Array Substrate

[Translation done.]